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| 10/506,895 | 09/07/2004 | Ichiroh Yamasaki | LB-900-505 | 5426 |
| 23117 7590 04/14/2009 NIXON & VANDERHYE, PC 901 NORTH GLEBE ROAD, 11TH FLOOR ARLINGTON, VA 22203 | | | | |
| EXAMINER | | | | |
| MOWLA, GOLAM | | | | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/506,895

Applicant(s)

YAMASAKI ET AL.

Examiner

GOLAM MOWLA

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 February 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6, 8, 10 and 11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8 and 10-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/S508)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____
- Paper No(s)/Mail Date _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/06/2009 has been entered.

Response to Amendment

2. Applicant's amendment of 02/06/2009 does not place the Application in condition for allowance.

3. Claims 1-6, 8 and 10-11 are currently pending. Applicant has amended claims 1, 6 and 8, and cancelled claims 7 and 9.

Response to Arguments

4. Applicant's arguments with respect to claims 1-6, 8 and 10-11 have been considered but are moot in view of the new ground(s) of rejection as necessitated by the amendments.

Applicant argues that the prior art of record alone or in combination fails to teach each element of the claimed subject matter.

This argument is persuasive and is moot in view of new ground of rejection as presented below.

Status of the Objections or Rejections

5. Due to Applicant's amendment of claims 1, 6 and 8, all rejections from the office Action mailed on 11/07/2008 are withdrawn. However, upon further consideration, a new ground of rejection is presented below.

Status of the Objections or Rejections

6. Due to Applicant's amendment of claims 1, 6 and 8, all rejections from the office Action mailed on 11/07/2008 are withdrawn. However, upon further consideration, a new ground of rejection is presented below.

Drawings

7. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, a thicker concave portion and thinner convex portion wherein each convex portion has the front electrode (as claimed in claim 5) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for

consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

8. The amendment filed on 07/09/2008 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

- "forming a front electrode that is in partial direct physical contact with the convex portion which constitutes a part of the semiconductor substrate surface" as recited in lines 9-10 of claim 6. The original disclosure as filed shows that that the front electrode is in partial direct contact with the second conductivity type semiconductor layer (figs. 1-2 and 4-6 of instant application), not with the convex portion which constitutes a part of the semiconductor substrate surface.
- "forming a front electrode that is in partial direct physical contact with the concave portion which constitutes a part of the semiconductor substrate surface" as recited in lines 9-10 of claim 8. The original disclosure as filed shows that the front electrode is in partial direct contact with the second

conductivity type semiconductor layer (figs. 1-2 and 4-6 of instant application), not with the concave portion which constitutes a part of the semiconductor substrate surface.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. Claims 6 and 8 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 6 recites the limitation "forming a front electrode that is in partial direct physical contact with the convex portion which constitutes a part of the semiconductor substrate surface" in lines 9-10. The original disclosure as filed shows that that the front electrode is in partial direct contact with the second conductivity type semiconductor layer (figs. 1-2 and 4-6 of instant application), not with the convex portion which constitutes a part of the semiconductor substrate surface. Applicant is asked to clarify.

Claim 8 recites the limitation "forming a front electrode that is in partial direct physical contact with the concave portion which constitutes a part of the semiconductor substrate surface" in lines 9-10. The original disclosure as filed shows that the front

electrode is in partial direct contact with the second conductivity type semiconductor layer (figs. 1-2 and 4-6 of instant application), not with the concave portion which constitutes a part of the semiconductor substrate surface. Applicant is asked to clarify.

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. Claims 5, 6 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 5 is indefinite because it recites the limitation "each convex portion has the front electrode" in lines 1-2. Since claim 5 depends on claim 4, it requires thicker concave portion and thinner convex portion and only fig. 6 of instant application depicts thicker concave portion and thinner convex portion. However, fig. 6 shows that each concave portion has the front electrode, not the convex portion. Therefore, it is not clear whether the Applicant's intention was to claim "each concave portion has the front electrode." Applicant is asked to clarify.

Claim 6 is indefinite because it recites the limitation "forming a front electrode that is in partial direct physical contact with the convex portion which constitutes a part of the semiconductor substrate surface" in lines 9-10. The original disclosure as filed shows that that the front electrode is in partial direct contact with the second conductivity type semiconductor layer (figs. 1-2 and 4-6 of instant application), not with the convex portion which constitutes a part of the semiconductor substrate surface. Therefore, it is not clear whether the Applicant's intention was to claim "forming a front

electrode that is in partial direct physical contact with the second conductivity type semiconductor layer.”

Claim 8 is indefinite because it recites the limitation “forming a front electrode that is in partial direct physical contact with the concave portion which constitutes a part of the semiconductor substrate surface” in lines 9-10. The original disclosure as filed shows that the front electrode is in partial direct contact with the second conductivity type semiconductor layer (figs. 1-2 and 4-6 of instant application), not with the concave portion which constitutes a part of the semiconductor substrate surface. Therefore, it is not clear whether the Applicant’s intention was to claim “forming a front electrode that is in partial direct physical contact with the second conductivity type semiconductor layer.”

Claim Rejections - 35 USC § 102

13. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

14. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Nakai et al. (US 6207890, as cited in previous office action).

Regarding claim 1, Nakai discloses a photoelectric conversion device (see fig. 11 and col. 1, lines 6-8) using a first conductivity type semiconductor substrate (intrinsic amorphous silicon layer 2; see fig. 11 and col. 1, lines 40-51) having convex and concave portions (as shown in fig. 11) formed on its surface (fig. 11 shows formation of convex and concave portion on the upper surface of the substrate 2), the device comprising at least:

- a second conductivity type semiconductor layer (p-type amorphous silicon layer 3; see fig. 11 and col. 1, lines 40-51) formed on the surface of the first conductivity type semiconductor substrate (2) and being in direct contact with the first conductivity type semiconductor substrate (2) (see fig. 11);
- a front electrode (4) connected to the second conductivity type semiconductor layer (3) (see also fig. 11 and col. 1, lines 47-51);
- a rear electrode (back electrode 6) formed on the rear surface of the first conductivity type semiconductor substrate (2) (see col. 1, lines 50-51),
- the second conductivity type semiconductor layer (3) being partially in direct physical contact with the front electrode (4) and becoming thinner as it goes farther from the contacted area (layer 3 becomes thickest at the peak, i.e., convex portion and thins out as it goes away from the peak; see fig. 11 and also col. 2, lines 2-11).

Regarding claim 2, Nakai further discloses that the convex portions of the semiconductor substrate (2) are arranged at given intervals (as shown in Figure 11) and the second conductivity type semiconductor layer becomes (3) thinner from the convex portions (peak) (see fig. 11) to the concave portions (trough) (see fig. 11) of the substrate (2) (col. 2, lines 5-9).

Regarding claim 3, Nakai further discloses that each convex portion has the front electrode (4) (as shown in Figure 11) (col. 1, lines 47-48).

15. Claims 1, 4, 5 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Okamoto et al. (JP 04-356972A, cited in IDS, refer to translation as provided).

Regarding claim 1, Okamoto discloses a photoelectric conversion device (fig. 1 and [0018-0025]) using a first conductivity type (P-type) semiconductor substrate (P-type semiconductor substrate 10) having convex (peak) and concave (trough) portions (as shown in fig. 1) formed on its surface (fig. 1 shows formation of convex (peak) and concave (trough) portion on the upper surface of the substrate 10), the device comprising at least:

- a second conductivity type semiconductor layer (N-type semiconductor layer 1) formed on the surface of the first conductivity type semiconductor substrate (10) and being in direct contact with the first conductivity type semiconductor substrate (10) (see fig. 1 and [0018]);
- a front electrode (collecting electrode 5) connected to the second conductivity type semiconductor layer (1) (fig. 1);
- a rear electrode (rear-surface electrode 6) formed on the rear surface of the first conductivity type semiconductor substrate (10) (fig. 1),
- the second conductivity type semiconductor layer (1) being partially in direct physical contact with the front electrode (5) and becoming thinner as it goes farther from the contacted area (layer 1 becomes thickest at the concave portion and thins out as it goes away from the concave portion to the convex portion, see fig. 1).

Regarding claim 4, Okamoto further discloses that the convex portions (peak) of the semiconductor substrate (10) are arranged at given intervals (as shown in Figure 1) and the second conductivity type semiconductor layer becomes (1) thicker from the top

of the convex portions (peak) (see fig. 1) to the concave portions (trough) (see fig. 1) of the substrate (2) ([0018-0019]).

Regarding claim 5, Okamoto further discloses that each convex portion has the front electrode (5) (as shown in fig. 1) (Fig. 1 of Okamoto shows thicker concave portion and thinner convex portion similar to fig. 6 of instant application. Also, fig. 1 of Okamoto shows that the front electrode 5 is formed on the concave portion similar to fig. 6 of instant Application. Therefore, it is Examiner's position that each convex portion has the front electrode).

Regarding claim 8, Okamoto discloses method for manufacturing a photoelectric conversion device (fig. 1 and [0018-0025]) comprising the steps of:

- (a) forming a film (N-type semiconductor layer 1) containing second conductivity type (N-type) impurities on a semiconductor substrate (P-type semiconductor substrate 10) having convex (peak) and concave (trough) portions (as shown in fig. 1) formed on its surface (fig. 1 shows formation of convex (peak) and concave (trough) portion on the upper surface of the substrate 10) in such a manner that the film becomes thicker from the convex portion (peak) to the concave portion (trough) (layer 1 becomes thickest at the concave portion and thins out as it goes away from the concave portion to the convex portion, see fig. 1); and
- (b) implanting second conductivity type impurities (N-type) into the semiconductor substrate (10) from the film (1) to form a second conductivity

- type semiconductor layer (N-type semiconductor layer 1) on the surface of the semiconductor substrate (10) ([0018]); and
- (c) forming a front electrode (collecting electrode 5) that is in partial direct physical contact with the concave portion (trough) which constitute a part of the semiconductor substrate (10) surface (upper surface) (see fig. 1).

Examiner notes that the front electrode, as claimed, can not be in partial direct physical contact with the concave portion which constitutes a part of the semiconductor substrate surface, due to presence of an intervening layer - second conductivity type semiconductor layer.

16. Claim 6 is rejected under 35 U.S.C. 102(b) as being anticipated by Nishitani et al. (US 6023020).

Nishitani discloses a method for manufacturing a photoelectric conversion device (see fig. 2 and 2; col. 3, lines 9-61) comprising:

- (a) forming a film (high-resistance film 7; see fig. 2; col. 3, lines 9-15; col. 3, lines 41-61; and col. 4, line 56 to col. 5, line 2) serving as a barrier against impurity diffusion on a semiconductor substrate (light absorbing layer 3 as shown in fig. 2; see col. 3, lines 16-24; and col. 4, lines 3-13) having convex (peak) and concave (trough) portions (see fig. 2) formed on its surface (upper surface) in such a manner that the film (7) becomes thicker from the convex (peak) portion to the concave (trough) portions (fig. 2 which shows that high-resistance film is formed at the concave portion and therefore the thickness is

- largest and the thickness goes to zero at it moves towards the convex portion);
- (b) implanting second conductivity type (n-type) impurities (window layer 4; see fig. 1 and col. 3, lines 25-32) into the semiconductor substrate (3) through the film (7) (see fig. 2) to form a second conductivity type semiconductor layer (n-type as it forms PN junction with p-type substrate 3) on the surface of the semiconductor substrate (3);
- (c) forming a front electrode (transparent conductive film 5, fig. 2) that is in contact with the convex portion (peak) (fig. 2) which constitutes a part of the semiconductor substrate (3) surface (upper surface).

Examiner notes that the front electrode, as claimed, can not be in partial direct physical contact with the convex portion (see fig. 2) which constitutes a part of the semiconductor substrate surface, due to presence of an intervening layer-second conductivity type semiconductor layer.

Claim Rejections - 35 USC § 102/103

17. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
18. Claim 10 is rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as being unpatentable over Okamoto as applied to claim 1 above.

Applicant is directed above for complete discussion of Okamoto with respect to claim 1, which is incorporated herein. Fig. 1 of Okamoto depicts that the partial contact

between the second conductivity type semiconductor layer (1) and the front electrode (5) is substantially a point (see fig. 1 of Okamoto which shows a substantially point partial contact as shown in the instant application in fig. 2, therefore it is Examiner's position that the partial contact is substantially point).

In an alternative, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the front electrode (5) of Okamoto in any desired shape such that the current collection can be optimized (since front electrode 5 acts as the current collecting electrode), as desired by Okamoto. In addition, the configuration of the front electrode is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed front electrode is significant and would provide a distinct photoelectric conversion device. *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). MPEP §2144.04 IVB.

Claim Rejections - 35 USC § 103

19. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

20. Claim 11 is rejected under 35. U.S.C. 103(a) as being unpatentable over Okamoto in view of Matsuyama et al. (US 6072117).

Applicant is directed above for complete discussion of Okamoto with respect to claim 1, which is incorporated herein. One reading Okamoto as a whole would have readily appreciated that the front electrode (5) of Okamoto can have any desired shape.

However, the reference is silent as to whether the partial contact between the second conductivity type semiconductor layer (1) and the front electrode (5) is a straight line.

Matsuyama teaches a photoelectric conversion device wherein the front electrode (108) (fig. 1) is linearly arranged on the semiconductor layers.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the linear front electrode of the Matsuyama as the front electrode in the photoelectric conversion device of Okamoto, because doing so only predictable results of current collection would have been achieved, as shown by Matsuyama and also desired by Okamoto (since front electrode 5 of Okamoto acts as the current collecting electrode). In addition, the configuration of the front electrode is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed front electrode is significant and would provide a distinct photoelectric conversion device. *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). MPEP §2144.04 IVB.

Correspondence/Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GOLAM MOWLA whose telephone number is (571) 270-5268. The examiner can normally be reached on M-F, 0900-1700 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ALEXA NECKEL can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/G. M./
Examiner, Art Unit 1795

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1795